Dominance of Mollusca in the Benthic Population off Cochin

BY

B. N. Desai

Biological Oceanography Division, National Institute of Oceanography, Cochin, Kerala

(*With a map and a text-figure*)

The importance of molluscan fauna in the benthic population in and around Cochin harbour has been shown. The molluscs contribute a substantial portion of the benthic biomass; where the substrata and the environmental conditions are favourable, rich molluscan beds occur, forming more than 90% of the total biomass. Even in areas where the total biomass is poor, the molluscan fauna still forms a substantial portion of the benthos. The presence of rich beds of lamellibranch *M. ovum* and *M. striatus* off Cochin harbour might, it is suggested, contribute substantially as a food of larger carnivores.

Introduction

An account of the distribution and abundance of the benthic fauna of the Cochin backwater and the nearshore region around Cochin has been given recently (Desai & Krishnan Kutty, 1967a, 1967b). The ecological features influencing their distribution and abundance have also been discussed. A striking feature of the data was the predominance of mollusca over all other organisms, both in the backwater and in the nearshore regions. A study of the distribution and dominance of mollusca in this region was therefore made and the salient features are discussed here.

Material and Methods

Data for the present paper were obtained from the samples collected for the general study of the bottom fauna during the period, September 1965 to January 1968. The method of collection, gears used and the mode of preservation have already been described elsewhere (Desai & Krishnan Kutty 1967a). The molluscan forms were sorted out from the samples and preserved separately in 5% formalin. These were identified and the number of organisms belonging to each species was recorded separately. Their dry weight was determined after removing the shells. The shells were removed either by dissection or by dissolving them in weak hydrochloric acid in the case of smaller forms. Samples of the

substrata were also collected from the same stations for determining the nature of the bottom sediment.

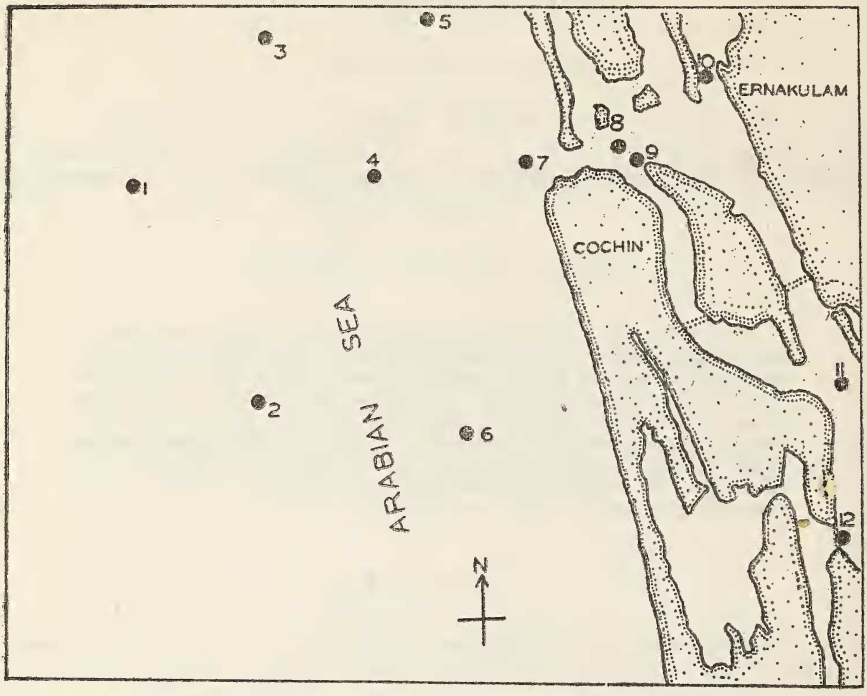

Fig. 1—Map of the Cochin backwater and the nearshore region off Cochin, showing 12 sampling stations.

Sampling Area

Twelve sampling stations were selected in the area under investigation (Map). Stations 1 to 6 were located in the nearshore region, whereas station 7 was at the confluence of the sea and the backwater. Stations 8 and 9 were in the marine zone of the backwater. The depth at different stations varied from 1-5 metres in the backwater and 10 to 12 metres at stations 2, 3, 4, 5 and 6 and about 18 metres at station 1 which was located at a distance of about 7 miles off Cochin. The area sampled presented a variety of habitat both in hydrographic conditions and in the nature of substrate. Typically brackish conditions were prevalent at the surface of the backwater, where the salinity showed wide fluctuation. The bottom salinity varied from 33.06‰ to 35.41‰ in the pre- and post-monsoon months. For details of hydrographic condition see Desai & Krishnan Kutty (1967 a & b).

Substrata

The substrata of the different stations studied could be broadly classified into three main groups: (1) muddy, (2) sandy and (3) mixed

type with fine sand and varying amounts of silt and clay. The percentage of sand, silt and clay in a typically muddy, sandy and mixed substrata is given in Table 1. Stations 1, 2, 3, 6 and 10 had muddy bottom, whereas stations 4, 7, 8 and 12 were sandy and stations 5, 9 and 11 were characterised by a mixed type of substrata, consisting of fine sand with varying amounts of silt and clay.

TABLE 1

PERCENTAGE COMPOSITION OF A TYPICALLY MUDDY, SANDY AND MIXED TYPE OF SUBSTRATA AROUND COCHIN HARBOUR

Nature of substrata	Gravel	Very coarse sand	Coarse sand	Medium sand	Fine sand	Silt	Clay
Muddy	..	..	..	..	2.38	62.15	35.46
Sandy	16.31	2.52	8.50	46.88	25.76	..	..
Mixed	..	..	4.54	34.57	22.62	12.53	25.73

Molluscan fauna in relation to substrata

Although molluscs predominated over other groups of benthic forms, their abundance and species composition varied at different stations mainly because of the nature of substrata and changes in the salinity. Since the bottom deposits can be classified into three main types, it is proposed to describe the molluscan fauna in relation to these three types of substrata.

Muddy bottom :

At stations 1, 2, and 3 which are characterised by a muddy substratum, the bivalves were represented by *Meretrix ovum* which was fairly abundant. Only juveniles of *M. ovum*, measuring 1.5 to 2 mm. in size were collected at this station. This indicated a fairly recent settlement of this bivalve, which probably were transported by the waves from the shore stations, where rich beds of *M. ovum* were found. Among the gastropods, *Canculus clanguloides*, *Nassa ceylonica*, *Conus punctatus* and *Cerethium tressa* were the most common forms. *Dentalium esper* and *Cavelinea* sp. occurred occasionally in fairly large numbers. The planktonic pteropod's (*Cavelinea*) occurrence at the bottom may be due to accidental sinking.

Station 6 which was nearer to the shore, was expected to be predominantly sandy, but was found to have a muddy substratum. This was due to the deposition of mud dredged from the port's approach

TABLE 2

NUMBER AND DRY WEIGHT OF MOLLUSCA AT 12 STATIONS LOCATED AROUND COCHIN HARBOUR

Faunal Groups	Stations											
Nature of Substrata	1	2	3	4	5	6	7	8	9	10	11	12
	Muddy	Muddy	Muddy	Sandy	Mixed	Muddy	Sandy	Sandy	Mixed	Muddy	Mixed	Sandy
BIVALVIA												
1. *Meretrix ovum*	158	20	50	42	—	*	2,135	475	12	—	—	—
2. *Modiola striatus*	—	—	—	—	484		—	433	28	—	—	—
3. *Nuculana mauritiana* ..	—	—	—	—	—		—	—	—	5	68	750
GASTROPODA												
4. *Canculus clanguloides* ..	146	40	20	504	60		750	68	80	—	—	—
5. *Conus punctatus*	149	—	100	525	—		—	—	—	—	—	—
6. *Nassa ceylonica*	74	—	—	63	—		—	—	—	—	—	—
7. *Cerethium tressa*	—	40	60	—	50		—	—	—	—	—	—
8. Settling Stages	—	—	—	—	—		—	—	3,000	1,817	11,268	250
9. *Dentalium esper*	65	—	—	—	—		—	—	—	—	—	—
Biomass—gm./m² Mollusca	3.929	0.3818	0.980	3.434	20.468		386.610	113.22	11.158	0.077	0.978	10.435
Total ..	6.368	0.7818	1.510	3.453	22.868	0.036	394.426	118.17	15.647	3.351	2.442	10.674

* Plenty of dead shells.

channels. This muddy bottom extended for about 5 miles from the approach channel. Only the empty shells of the bivalve *Modiola striatus* were found here in large numbers. A few polychaetes were the only live organisms recorded in this area.

Station 10 in the backwater was also predominantly muddy, but the fauna here was poor. This might be due to considerable variations in the salinity, which probably reaches unfavourable limits for the benthic animals. None of the molluscs recorded from the nearshore region was present at this station. A small bivalve, *Nuculana mauritiana* and some newly settled stages of gastropods were the only molluscan representatives.

Sandy bottom :

Rich and extensive beds of the bivalve, *M. ovum* were found at stations 4, 7 and 8 which had sandy substrata. Bivalves of all sizes from settling to the adult stages were collected in large numbers; but at station 4 only smaller forms were present. During the monsoon months another bivalve, *M. striatus* was also seen quite abundantly at stations 7 and 8. This species appears to be an estuarine form which extends seawards when the salinity of water during the monsoon months becomes appreciably low. Cherian (1968) has reported extensive beds of this bivalve off Ernakulam jetty in the estuarine zone of the backwater. Among the gastropods, *C. clanguloides* was the most common form. *N. ceylonica, C. punctatus, Murex* sp. and *Subulina* sp. were also present.

Station 12, which was farthest from the sea, was situated in the southernmost part of the backwater and had a sandy bottom. *N. mauritiana* was the only abundant bivalve and the gastropods were represented by newly settled stages. No adult gastropods were normally recorded at this station.

Mixed bottom :

Substratum consisting of fine or medium sand with varying amounts of silt and clay were found in the Cochin backwater at stations 5, 9 and 11. Station 5 was located in the nearshore region opposite to the coastline of Vipeen Island and station 9 was in the marine zone of the backwater, near the confluence region. These stations supported a rich fauna consisting of *M. ovum, M. striatus* and *C. clanguloides,* apart from polychaetes and other organisms.

Station 11 which was situated in the estuarine zone of the backwater and had a mixed type of bottom sediments, had a poor molluscan fauna. *N. mauritiana* and a large number of settling stages of gastropods were

recorded. These probably failed to grow any further due to adverse hydrographic conditions or migrated shorewards where the conditions were suitable for growth.

Numerical abundance and biomass

The results of the quantitative examination of the samples collected from 12 stations are summarised in Table 1 and text-figure. The results indicate that a large portion of the biomass was composed of molluscs alone, at almost all the stations; but these were particularly dominant at those stations which had sandy substrata (Fig. 2). From Table 2 it can be seen that the fauna on the whole is poorer in the estuarine region of the backwater and in the nearshore region, excepting at station 12 where because of favourable sandy substratum, the biomass was high. Relatively poor biomass at stations 4 and 6 in the nearshore region, despite the favourable hydrographic conditions, may be because of the effect of the constant dredging of the approach channel for navigational purposes, thus disturbing the settled animals.

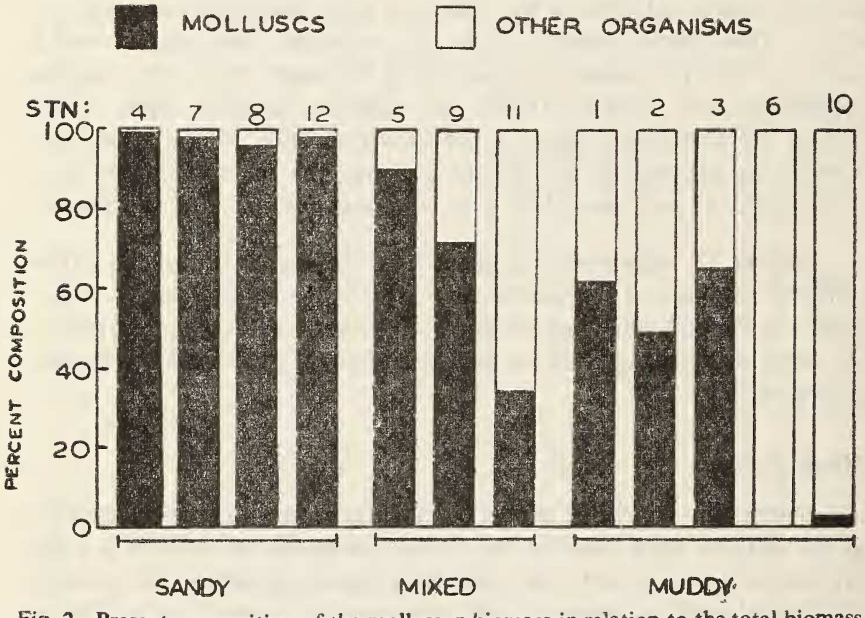

Fig. 2—Present composition of the molluscan biomass in relation to the total biomass at twelve sampling stations in the backwater and the nearshore regions off Cochin.

The highest biomass (386 gm./m^2) was recorded at station 8 which is situated at the confluence zone. The presence of rich beds of *M. ovum* was mainly responsible for this high value. The presence of hard substratum and less turbid waters probably favoured the successful settlement

of the molluscan larvae. On a muddy or mixed type of substrata of fine sand with varying amounts of silt and clay, the faunal groups, other than molluscs were better represented. It is evident from Fig. 2 that on a sandy substratum the molluscs contribute as much as 90 to 95% of the total biomass, whereas on muddy and mixed bottoms the total biomass is largely contributed by the other groups, mollusca forming nearly 30 to 60% of the total biomass.

Since quantitative studies on the benthos of Indian waters are few, the abundance of molluscan fauna around Cochin harbour cannot be easily compared with those of other areas. Sheshappa (1953) has reported the benthic fauna near Calicut, at 6 to 10 fathoms, ranging from 10 to 35 gm./m^2, which was largely contributed by molluscs. However, the figures given by Sheshappa refer to wet weight of animals with shells and tubes intact and hence it appears that the areas around Cochin harbour sustain a richer molluscan fauna than the Calicut areas. Cherian (1968) has also indicated that a rich molluscan fauna exists in this region. Kurian (1955) while studying the benthic fauna of the Travancore coast showed that the foraminifera, mollusca and the crustaceans constitute the benthos of that region.

Several instances of the dominance of different groups in different parts of the world are available. Ellis (1960), for instance, while studying the marine benthos fauna in the Arctic region of North America, stated that various groups of animals were dominant in various places. The lamellibranchs represented between 60 and 80% of the biomass in North Baffin Island and New Godthaab but these were partly replaced by polychaetes in shallow waters in Disco Bay. He reported a biomass of 438 gm./m^2 on sandy bottom and 100 gm./m^2 on muddy shores. Southward (1957) described the dominance of polychaetes in the offshore deposits of the Irish Bay.

A comparison of these values with those reported in the present communication shows that some areas on the west coast of India are significantly rich in molluscan forms. Their abundance may conceivably be an important link in the food chain of higher carnivores. Although the adults of larger molluscs such as *Meretrix* may not be directly utilised because of their thick shells, the younger stages of the species may form an important item of food of demersal fish, crabs and prawns.

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